

Appl. No. : 09/982,454
Filed : October 17, 2001

REMARKS

Claims 18-20 have been canceled as being directed to a non-elected invention. Claim 1 has been amended to clarify the invention by incorporating the limitations of Claims 6 and 8 and further limitations. Claim 10 has been amended to clarify the invention by incorporating the limitations of Claim 17 and further limitations. Claims 6, 8, and 17 have been canceled accordingly. Support for the amendments can be found in the drawings (except for Figure 5 which does not have a lip portion and is used for a thermal CVD apparatus) and additionally at page 8, lines 27-28, for example. Clarifying amendments have been made to Claims 4, 7, and 13. No new matter has been added. Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE." Applicant respectfully requests entry of the amendments and reconsideration of the application in view of the amendments and the following remarks.

Affirmation of Election

A provisional election was made without traverse to prosecute the invention of Group I, claims 1-17. Applicant affirms the above election and accordingly cancels Claims 18-20 as being directed to a non-elected invention.

Priority

Foreign priority has been claimed and acknowledged. However, the Examiner asserts that Applicant has not filed a certified copy of the priority document. Contrary to the Examiner's assertion, a certified copy of the priority document was filed on January 18, 2002 (certificate of mailing dated December 21, 2001), and then due to the US Postal Service sanitization process, Applicant received the Request for Substitute Papers mailed July 11, 2002. In response to the Request, Applicant faxed a copy of the substitute papers on July 23, 2002. All of the above transactions are evidenced by the attached copies of the documents. Thus, Applicant should not be required again to submit a certified copy of the priority document. Applicant requests that the attached copy of the documents be accepted.

Rejection Under 35 U.S.C. § 112

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Claims 4 and 13 have been rejected under 35 U.S.C. § 112, second paragraph, with regard to the phrases "said concave surface". The Examiner suggests deleting "surface" and inserting --portion--. The claims have been so amended, thereby obviating this rejection.

Rejection of Claims 1, 2-4, 6, 8-11, 13, 15, and 17 Under 35 U.S.C. § 102(a)

Claims 1, 2, 4, 6, 8-11, 13, 15, and 17 have been rejected under 35 U.S.C. § 102(a) as being anticipated by Inokuchi (JP 2001-127142). However, Inokuchi's publication date is May 11, 2001 which is later than the foreign priority date of the present application, which is October 19, 2000. An English translation of the priority document is enclosed herewith, which shows that the presently claimed invention is disclosed in the priority document. Thus, Inokuchi does not serve as a prior art. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 3 and 12 Under 35 U.S.C. § 103(a)

Claims 3 and 12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Inokuchi in view of Yamada (US 4986215). However, as explained above, Inokuchi does not serve as a prior art, and thus, this rejection is moot. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 5 and 14 Under 35 U.S.C. § 103(a)

Claims 5 and 14 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Inokuchi in view of Hurwitt (US 5925226). However, as explained above, Inokuchi does not serve as a prior art, and thus, this rejection is moot. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 7 and 16 Under 35 U.S.C. § 103(a)

Claims 7 and 16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Inokuchi in view of Bedi (US 6094334). However, as explained above, Inokuchi does not serve as a prior art, and thus, this rejection is moot. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 1, 2, 8-11, and 17 Under 35 U.S.C. § 102(b)

Claims 1, 2, 8-11, and 17 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Gurary (US 6001183). Claims 6, 8, and 17 have been canceled without prejudice. With regard to Claim 1, the limitations of Claim 6 which has not been rejected on this ground have been incorporated into Claim 1 in addition to the other limitations. Thus, Claim 1 and dependent Claims 2 and 9 could not be rejected on this ground.

With regard to Claim 10, Claim as amended herein recites: (I) The claimed apparatus is a plasma apparatus; (II) a single semiconductor substrate is supported; (III) the substrate-supporting surface has a concave portion slanting toward the center; (IV) only a peripheral portion of the back surface of the substrate contacts the slanting surface; (V) the lip portion protruding in a ring shape at the periphery has a top surface and a slanted inner side surface to prevent a plasma from converging on either the lip portion or the substrate; and (VI) the top surface is configured to be of substantially the same height as a top surface of the substrate when loaded.

In contrast, in Gurary, the apparatus is a thermal CVD apparatus, not a plasma CVD apparatus, as clearly shown in Figure 1. Thus, in Gurary, thermal uniformity is much more critical than in a plasma CVD apparatus. The prior art does not recognize a thermal uniformity problem in a plasma CVD apparatus. See also Yamada (US 4986215).

Further, in Gurary, the apparatus supports multiple substrates at once, and thus thermal uniformity is much more critical than in a single wafer-treating apparatus. The prior art does not recognize a thermal uniformity problem in a single-wafer treating apparatus. See also Yamada (US 4986215). Although Gurary discloses a single wafer treating susceptor in Figures 14, 15, and 16, the surface is not concave slanting toward the center, and further, a portion other than a portion of the back surface of the wafer contacts the slanting portion of the susceptor. These configurations are irrelevant to the claimed configuration.

Furthermore, in Gurary, because the apparatus is a thermal CVD apparatus, the lip portion is in no way used for preventing an arc. As clearly shown in Figure 8A of Gurary (or Figures 14-16), the wafer is just fitted in the recess, and there is no gap between the outer periphery of the wafer and the inner periphery of the recess. This configuration is effective in a thermal CVD apparatus (heat conduction from the periphery). However, in a plasma CVD apparatus, in the case where a periphery of the wafer is not perfectly fitted in the recess, an arc occurs. In the present invention, the lip portion has a slanted inner side and the height of the lip portion is substantially the same as

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the wafer, so that irregular plasma discharge can effectively be prevented. This aspect is in no way taught by Gurary.

Thus, Claim 10 is clearly distinct from and could not be anticipated by Gurary. Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 3 and 12 Under 35 U.S.C. § 103(a)

Claims 3 and 12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Gurary in view of Yamada. Claims 3 and 12 are dependent on Claims 1 and 10, respectively. However, as explained above, Gurary does not teach Claim 1 or Claim 10 as amended herein. Yamada shows Figure 8A as a prior art by referring to JP 59-50095 (and the corresponding U.S. patent, US 5,242,501 to McDiarmid) and 62-4315, which have been submitted herewith in the form of an IDS. As shown in these JP publications and the U.S. patent (McDiarmid), the susceptors do not have a lip portion having the same height as the wafer and a slanted inner side wall, seriously causing an arc in a plasma CVD apparatus. As recited in Claim 1 of McDiarmid, the side walls of the cavity is perpendicular to the susceptor surface, not slanted. McDiarmid clearly teaches away from the lip portion recited in the present claims. Further, all of Yamada's and the cited prior art's apparatuses are thermal CVD apparatuses, and they support multiple wafers at once. As described in McDiarmid (column 1, lines 37, column 2, lines 3-17), the thermal CVD apparatus uses very high temperatures (unlike a plasma CVD apparatus) and that causes crystallographic dislocations or slip in the wafer. Because a plasma CVD apparatus does not have this problem, there is no motivation to apply Yamada's or the cited prior art's susceptors to a plasma CVD apparatus. Furthermore, Yamada's or the cited prior art's susceptors in no way address or suggest the plasma arcing problem. Thus, the teachings of Gurary and Yamada could not lead to Claim 10 or dependent Claim 12. These claims could not be obvious over Gurary and Yamada.

Additionally, Claim 1 recites a heating element embedded below the concave portion (the limitations of Claim 6 which has not rejected on this ground), and a radio-frequency electrode of a metal element embedded below the concave portion. These features are in no way taught by the above references. Thus, Claim 1 and dependent Claim 3 could not be obvious over the references.

Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 4 and 13 Under 35 U.S.C. § 103(a)

Claims 4 and 13 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Gurary in view of Tsukuyama (JP 01-283813). Claims 4 and 13 are dependent on Claims 1 and 10, respectively. However, as explained above, Gurary does not teach Claim 1 or Claim 10 as amended herein. Tsukuyama shows the recess. However, Tsukuyama's apparatus is a thermal CVD apparatus (induction coil (4) heating type), and because of high heat, the wafer is warped and touches the bottom surface of the recess (see Figure 1(b)). The references do not address or suggest any problem in a plasma CVD apparatus. The arguments for Claims 1 and 10 above apply to this rejection. Further, Tsukuyama does not teach the lip portion of the present invention which is configured to prevent an arc (by having a slanting inner side). Thus, the teachings of Gurary and Tsukuyama could not lead to Claim 10 or dependent Claim 13. These claims could not be obvious over Gurary and Tsukuyama.

Additionally, Claim 1 recites a heating element embedded below the concave portion (the limitations of Claim 6 which has not rejected on this ground), and a radio-frequency electrode of a metal element embedded below the concave portion. These features are in no way taught by the above references. Thus, Claim 1 and dependent Claim 4 could not be obvious over the references.

Applicant respectfully requests withdrawal of this rejection.

Rejection of Claims 5 and 14 Under 35 U.S.C. § 103(a)

Claims 5 and 14 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Gurary in view of Hurwitt. Claims 5 and 14 are dependent on Claims 1 and 10, respectively. However, as explained above, Gurary does not teach Claim 1 or Claim 10 as amended herein. Further, Hurwitt's susceptor is clearly dissimilar to the one recited in the claims. That is, Hurwitt's susceptor has neither a concave surface slanting toward the center, nor a lip portion at the periphery. Hurwitt's disclosed distance is irrelevant to the distance recited in the claims. A combination of Gurary and Hurwitt could not reasonably be accomplished. Thus, Claim 10 and dependent Claim 14 could not be obvious over Gurary and Hurwitt.

Additionally, Claim 1 recites a heating element embedded below the concave portion (the limitations of Claim 6 which has not rejected on this ground), and a radio-frequency electrode of a metal element embedded below the concave portion. These features are in no way taught by the above references. Thus, Claim 1 and dependent Claim 5 could not be obvious over the references.

Applicant respectfully requests withdrawal of this rejection.

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Rejection of Claims 6, 7, 15, and 16 Under 35 U.S.C. § 103(a)

Claims 6, 7, 15, and 16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Gurary in view of Bedi. Claim 6 has been canceled. Claim 7 is dependent on Claim 1, and Claims 15 and 16 are dependent on Claim 10. However, as explained above, Gurary does not teach Claim 1 or Claim 10 as amended herein. Further, Bedi's susceptor is clearly dissimilar to the one recited in the claims. That is, Bedi's susceptor has neither a concave surface slanting toward the center, nor a lip portion at the periphery. Further, Gurary's apparatus is a thermal CVD apparatus whereas Bedi's apparatus is a plasma CVD apparatus, and they are structurally very different. Bedi does not address the problems the present invention resolves (irregular plasma discharge and thermal uniformity).

The Examiner is required to consider the following:

"The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a prima facie case of obvious was held improper." *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). M.P.E.P. 2143.01. Thus, even if all pieces of a puzzle are disclosed in references, there must be a suggestion or motivation to combine these pieces to complete the puzzle as with a jigsaw puzzle. Here, as explained above, Gurary and Bedi are very different, and a combination of these is in no way suggested. Further, even if Gurary and Bedi are combined, the lip portion structure and its function recited in the claims is not taught by either reference. Thus, this rejection is improper, and Applicant respectfully requests withdrawal of this rejection.

CONCLUSION

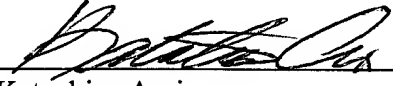
In light of the Applicant's amendments to the claims and the foregoing Remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

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Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 6, 8, and 17-20 have been canceled.

Claims 1, 4, 7, 10, and 13 have been amended as follows:

1. (Amended) A semiconductor substrate-supporting apparatus for supporting and heating a single semiconductor substrate inside a vacuum-pumped reaction chamber, comprising:

a substrate-supporting surface having a concave portion including a depression slanting toward the center of the substrate-supporting surface, wherein only a peripheral portion of the back surface of the substrate, when loaded, contacts the slanting surface of the concave portion;

a surface peripheral portion formed around the substrate-supporting surface, said surface peripheral portion having a lip portion which protrudes in a ring shape, said lip portion having a top surface and a slanted inner side surface to prevent a plasma from converging on either the lip portion or the substrate, said top surface being configured to be of substantially the same height as a top surface of the substrate when loaded;

a heating element embedded below the concave portion;

a radio-frequency electrode of a metal element embedded below the concave portion; and

no mechanical mechanism to clamp the substrate on the substrate-supporting surface.

4. (Amended) The apparatus as claimed in Claim 1, wherein said concave surface portion comprises a slanting portion and a flat portion.

7. (Amended) The apparatus as claimed in Claim ~~6~~1, ~~further comprising wherein at the~~ radio-frequency electrode of a metal element ~~which is embedded below said concave portion and above said heating element.~~

10. (Amended) A plasma CVD apparatus, comprising:

a vacuum-pumped reaction chamber;

a semiconductor substrate-supporting apparatus for supporting and heating a single semiconductor substrate inside the vacuum-pumped reaction chamber, said substrate-supporting apparatus comprising:

(i) a substrate-supporting surface having a concave portion including a depression slanting toward the center of the substrate-supporting surface, wherein only a peripheral portion of the back surface of the substrate, when loaded, contacts the slanting surface of the concave portion;

(ii) a surface peripheral portion formed around the substrate-supporting surface, said surface peripheral portion having a lip portion which protrudes in a ring shape, said lip portion having a top surface and a slanted inner side surface to prevent a plasma from converging on either the lip portion or the substrate, said top surface being configured to be of substantially the same height as a top surface of the substrate when loaded;

(iii) a heating element; and

(iv) no mechanical mechanism to clamp the substrate on the substrate-supporting surface.

13. (Amended) The apparatus as claimed in Claim 10, wherein said concave surfaceportion comprises a slanting portion and a flat portion.